



**SAP White Paper
SAP for High Tech**

FULFILLING THE PROMISE OF DISTRIBUTED MANUFACTURING

**How High-Tech Brand Owners Can Sense and
Respond to Changes Across the Supply Chain**

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EXECUTIVE SUMMARY

Outsourcing is increasingly embraced by high-tech manufacturers seeking new ways to reduce costs, increase agility, and enhance market competitiveness. Yet brand owners such as original equipment manufacturers (OEMs) and semiconductor companies face additional – and often unexpected – challenges when they engage in distributed manufacturing. Companies may source, manufacture, assemble, and conduct testing procedures at locations around the world, because they have chosen regional distribution facilities or because they rely on supply chain partners in far-flung locations. In many cases, these distributed manufacturing operations can compromise visibility and quality control, which in turn erodes execution, management effectiveness, and profitability. Inconsistent responsiveness and service gaps can degrade customer confidence in suppliers and jeopardize future business.

In fact, industry analyst Technology Forecasters Inc. (TFI) suggests that many brand owners are spending dramatically more money managing and administering supply chain relationships than necessary. Unchecked, these costs can compromise the cost-effectiveness and overall value of outsourcing. “The total cost of ownership of an outsourcing initiative creates hidden costs that the brand owner must absorb,” explains Bruce Rayner, director of research and consulting at TFI.

To optimize the value of outsourcing within a distributed manufacturing environment, brand owners must deploy business systems and procedures that create a collaborative, transparent information environment for manufacturing. “Brand owners require greater visibility into critical supply chain events,” he advises. “They also need solutions that help them synchronize partner relationships in a more automated and collaborative way.”

This white paper describes the impact on electronics brand owners of increased outsourcing for manufacturing operations. It also reviews the challenges and the process improvement opportunities available to companies that seek to enhance the effectiveness of distributed manufacturing operations – those that are outsourced as well as geographically dispersed operations that remain under internal control. The paper then discusses the primary visibility and collaboration needs of brand owners today and concludes by presenting solutions available from SAP to address these requirements.

“Brand owners require greater visibility into critical supply chain events. They also need solutions that help them synchronize partner relationships in a more automated and collaborative way.”

Bruce Rayner, Director of Research and Consulting, Technology Forecasters Inc.

HIGH TECH'S INCREASING RELIANCE ON DISTRIBUTED MANUFACTURING

Electronics manufacturers face market conditions radically different from those of even a few years ago. Product life cycles are shrinking rapidly, profit margins are declining, and global trade regulations are becoming more complex. Participants in many electronics supply chains are distributed both geographically and organizationally. Parts, subassemblies, and finished product assemblies are built at facilities around the world and distributed to an international customer base. High-tech supply chains routinely blend in-house and outsourced manufacturing operations.

Brand owners such as OEMs and fabless semiconductor companies are responsible for orchestrating, managing, and controlling these internal and external processes to ensure that they run smoothly. Remaining competitive in such “distributed manufacturing” environments demands new approaches to business operations. Accordingly, brand owners have been divesting key operations to take advantage of low-cost labor and risk reduction opportunities. For example, some companies relieved themselves of certain inventory and capacity responsibilities by shifting to outsourced operations – especially electronic manufacturing services (EMS). In fact, since the early 1990s, manufacturing outsourcing for electronics has grown dramatically to become a US\$200 billion industry.

By distributing operations, these companies decreased the required amount of capital investment and increased manufacturing flexibility – improvements that allowed them to respond more effectively to unexpected but inevitable changes in demand. Outsourcing also helps brand owners concentrate their operations on true competitive differentiators and core competencies. As a result, outsourcing has penetrated nearly all segments of high-tech manufacturing, including consumer, medical, telecommunications, computing, and chip fabrication devices.

Brand owners are expected to rely on outsourcing to an even greater extent in the coming years. As shown in Figure 1, analysts such as Technology Forecasters Inc. in Alameda, Calif., expect outsourcing for this market to grow into a US\$336 billion industry by 2009.

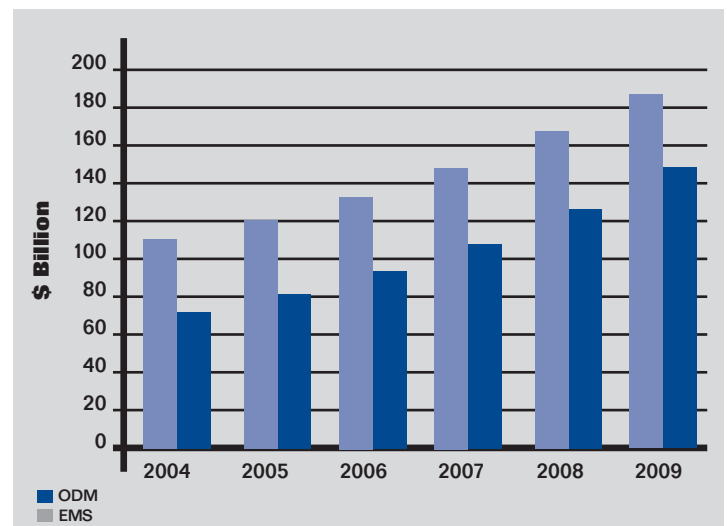


Figure 1: The Growing Market for Outsourced Electronic Manufacturing Services (EMS) and Original Design Manufacturer (ODM) Services (Source: Technology Forecasters Inc., 2006)

Uneven Results

Although the primary driver for embracing outsourcing has been the quest for lower costs and better financial performance, results have been uneven for many electronics manufacturers. The continuous challenges involved in controlling and mitigating the many risks and costs of global production have prevented some manufacturers from achieving the promised benefits of outsourcing. In reviewing hundreds of global electronics manufacturing case studies, TFI has exposed an unexpected reality about the success of outsourcing efforts.

Distributed manufacturing arrangements can create a dramatic reduction in labor, capital equipment, and overhead costs. However, these savings are frequently compromised and even offset by the cost of resources needed to manage programs and coordinate relationships. “For many brand owners, the internal costs of managing external contract manufacturers are often higher than the direct cost savings of outsourcing manufacturing,” reveals TFI senior consultant Charlie Barnhart. “In many cases, the net cost of manufacturing actually increases instead of falling.” Without appropriate systems and procedures, manufacturers can actually experience a loss of visibility and quality control – problems that can degrade execution and management, increase cost, and limit flexibility (see Figure 2).

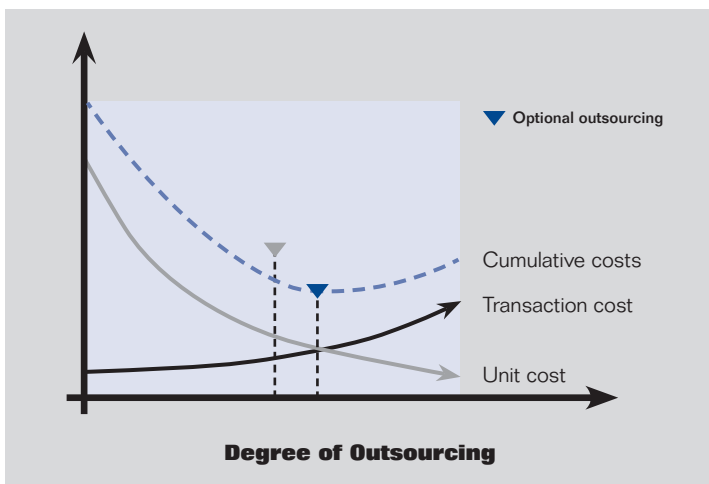


Figure 2: How Managing the Outsourcing Process Can Offset Savings

To optimize the value of outsourcing within a distributed manufacturing environment, brand owners need to deploy business systems and processes that create a collaborative, transparent information environment. These systems must do the following:

- Improve visibility to outsourced manufacturing activities on an exception basis
- Accelerate the orchestration of internal and external supply chain execution
- Improve integration both internally and externally (with manufacturing partners)
 - Provide timely detection and response to issues on shop floors across the entire manufacturing supply chain
 - Automate the seamless interaction between enterprise and shop-floor-level scheduling, execution, and quality management processes

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Charlie Barnhart, Senior Consultant, Technology Forecasters Inc.

The Execution Gap

To better understand the primary obstacles to success in distributed manufacturing environments, industry analyst TFI conducted extensive research into the challenges faced by brand owners. The resulting report, written by TFI senior consultant Matt Chanoff, is titled “EDS/ODM (Original Design Manufacturer) Report Card and Buyer’s Guide: Company Ratings, Customer Priorities, and Industry Best Practices from 103 Global Electronics OEMs.”

In this study, nearly 130 representatives of 103 brand owners were surveyed; each was asked to rate the importance of five capabilities expected of their contract manufacturers. As shown in Figure 3, the manufacturers' ability to reduce total cost of ownership (TCO) and enhance global supply chain coordination and execution were ranked highest – with scores of nearly 4.5 and more than 4.0 out of 5.0, respectively.

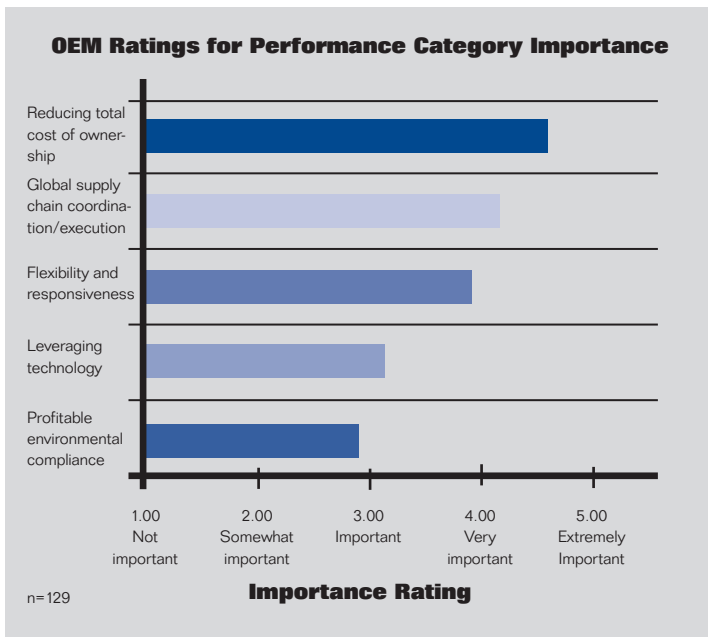


Figure 3: Critical Outsourced Manufacturer Capabilities, Ranked by Brand Owners (Source: Technology Forecasters Inc., 2006)

Yet when brand owners were asked to rate how well their outsourced manufacturers meet these goals, the contrast was striking (see Figure 4). According to the TFI report, “The study found an inverse relationship between the relative value OEMs place on the five performance categories and how well their EMS and ODM suppliers are performing. For example, reducing the total cost of ownership was of highest importance, yet in aggregate OEMs gave their suppliers relatively low marks in this area.” On a scale of 1 to 5, the brand owners rated their EMS/ODM supplier as just over 3. The outsourcers' ability to enhance global supply chain coordination and execution was also rated low, with only 3.4.

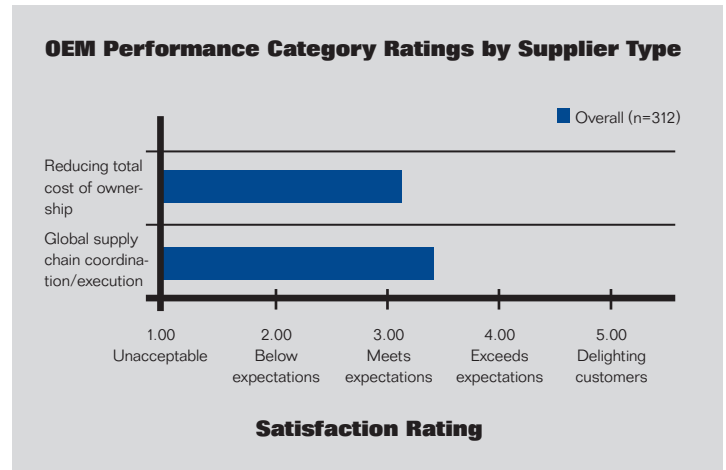


Figure 4: Overall Performance Category Ratings by Supplier Type (Source: Technology Forecasters Inc., 2006)

The gap between expectation and reality is larger than the study indicates. “Brand owners typically look at TCO from an assembly-unit price perspective,” explains Barnhart of TFI. “Because unit contract prices only comprise approximately 50% to 60% of the total cost of ownership, we can assume that the data indicates that the significance of the TCO issue extends well beyond the contracted unit price. It also addresses existing issues that are driven by the brand owner’s inability to understand and control internal management costs associated with managing the outsourcing relationship.”

Furthermore, brand owners struggle with an additional constraint: dynamic demand on various business processes. A company's processes must adapt with agility to rapidly shifting conditions, such as regulatory drivers, increasing frequency of product transitions, and a higher number of products. These constant changes must be managed effectively, while the brand owner simultaneously strives to improve the overall effectiveness of outsourcing programs.

Clearly brand owners are facing a dramatic gap between their distributed manufacturing requirements and the actual capabilities. Some industry-leading brand owners are finding ways to address this gap: by viewing the need to improve their critical business processes as opportunities.

The Need for End-to-End Supply Chain Visibility and Response

With distributed manufacturing, the time and distance between headquarters and the executing subsidiaries or contract companies commonly create barriers of visibility and response that can disrupt critical business processes. Even when visibility is established, the manual nature of many supply chain processes makes timely resolution of conflict impossible.

These problems are not insurmountable. In fact, brand owners who view them as opportunities for process improvement tend to experience greater success than their competitors. Three primary improvements are required to enhance distributed manufacturing, as follows.

Enhanced visibility – Supply chain participants must be able to share information about demand levels, stage of production, inventory levels, and lead times. Brand owners need visibility to reduce manufacturing cycle times, create more accurate forecasts, anticipate and manage component obsolescence to reduce costs and delays, and develop benchmarks that can be used to reduce product failures.

Improved supply chain orchestration and collaboration – Collaboration, both internally and with partners, is the linchpin of distributed manufacturing. Brand owners must be able to share more information faster. With improved collaboration, problems such as production delays, component shortages, obsolete and excess inventory, and product life-cycle management risk occur less frequently. In most environments, however, information sharing is still a manual process. In fact, according to the AMR Research article titled “High-Tech and Discrete: The Cobbler’s Children” (May 24, 2005), “Some surprising statistics on how brand owners communicate with their contract manufacturers include:

- 38% use traditional communications such as phone, hard copy, or fax for purchase orders, invoices, and settlement as the primary means of communication with some suppliers.
- The preferred option today is e-mail, with 65% sending files over the Internet.”

Brand owners require flexible solutions that enable the supplier to connect and communicate quickly and efficiently.

Increased systems integration – For the same reason, brand owners want to integrate their business systems, including applications and data silos, across the enterprise and with their partners. Supply chain solutions can improve the overall transparency of information within the brand owner’s organization; they can also enable brand owners to respond to supply chain events as they occur. When well integrated, these solutions can help manage customer demand and rapidly coordinate supply response with great flexibility, which improves both order fulfillment and responsiveness.

To make these improvements, brand owners need business solutions that provide the following features, as shown in this table.

REQUIRED IMPROVEMENT	KEY BENEFITS
Enhance visibility	<ul style="list-style-type: none"> ■ Provide easy-to-use, role-based, exception-based information through dashboards and portals ■ Improve shop-floor visibility into manufacturing activities, including open purchase orders, materials inventories, work-in-process status, and ship dates – whether in-sourced or outsourced ■ Manage supply network inventory, both within the enterprise and across multitiered supply chains
Improve orchestration and collaboration	<ul style="list-style-type: none"> ■ Accelerate internal and external supply chain execution with analytics and standards-based communication ■ Eliminate the latency of forecast and response exchanges with suppliers ■ Create flexible approaches to collaborative process exchange in order to manage supply chain disruptions
Increase systems integration	<ul style="list-style-type: none"> ■ Identify supply alternatives that are automated and predetermined when supply chain issues occur ■ Automate interactions between enterprise and shop-floor-level scheduling, execution, and quality management processes ■ Reduce planning cycle time and increase frequency

SAP SOLUTIONS FOR DISTRIBUTED MANUFACTURING

SAP has developed the SAP for High Tech solution portfolio to meet the unique needs of brand owners and other stakeholders in the distributed manufacturing supply chain. These industry-specific solutions are developed and supported through guidance and feedback from SAP customers and prospects. SAP® software includes features that help improve visibility, collaboration, and system integration, as follows.

Supply Chain Collaboration and Outsourced Manufacturing

While globalization and the increasing use of outsourcing make electronic information sharing essential, the dynamic nature of today's supply networks muddies the picture. Partners simultaneously play a variety of roles, and relationships often shift. It is not uncommon for brand owners and suppliers to play the role of customer or supplier at different times. For example, when contract manufacturers outsource to other manufacturers, they may be competing with their own customers. This environment makes it more difficult for companies that share information to keep lines of responsibility clear and adequately protect proprietary information.

Another collaboration concern arises when larger contract manufacturers offer supply chain management services to their customers. The processes by which these parties collaborate around fulfillment, visibility, inventory management, and planning can have unique and critical requirements. As EMS, ODM, foundries, and contract manufacturers seek to offer additional supply chain execution services for their customers, the business-to-business (B2B) process landscape must also adapt to this highly flexible environment. Failure to do so can present serious visibility and execution challenges for supply chain participants.

SAP business-to-business solutions for the supply chain are designed to address these critical collaboration challenges:

- Providing visibility into the extended supply chain and outsourced manufacturing operations
- Enabling collaboration among supply chain partners, reducing latency, and thus enabling agility in reacting to demand swings
- Ensuring compliance in areas such as global trade, inventory, and liability reporting
- Ensuring that B2B collaboration can be set up quickly, react flexibly to changes in processes or business models, and support a variety of collaboration scenarios

Accurately Managing Data and Responsibilities

The complexity of the relationship between brand owner and supplier challenges them both to maintain supply chain-wide inventory visibility and to track lines of responsibility and liability. One brand owner can manufacture a particular product, for example, and another may supply a key assembly. Localized variants of the product may be manufactured by different brand owners and EMS providers. Some of these partners may buy components or assemblies from each other. Any of the partners may fulfill orders and handle customer support directly. With so many relationships and responsibilities, it can be difficult for brand owners to understand their existing and projected supply requirements or to manage their customer expectations flexibly.

The SAP for High Tech solution portfolio offers role-based portals that enable collaboration by allowing all partners to work from a common view of current information. These portals structure data to the needs of any role that a stakeholder has adopted for a given product within the supply network. For partners with multiple, shifting relationships, these structured views illuminate both the individual lines of responsibility and state of liability for each stakeholder. They can also show the surrounding ecosystem of responsibilities and actions taken by partners, who can use these platforms not only to track information, but also to collaborate on forecasting and corrective actions.

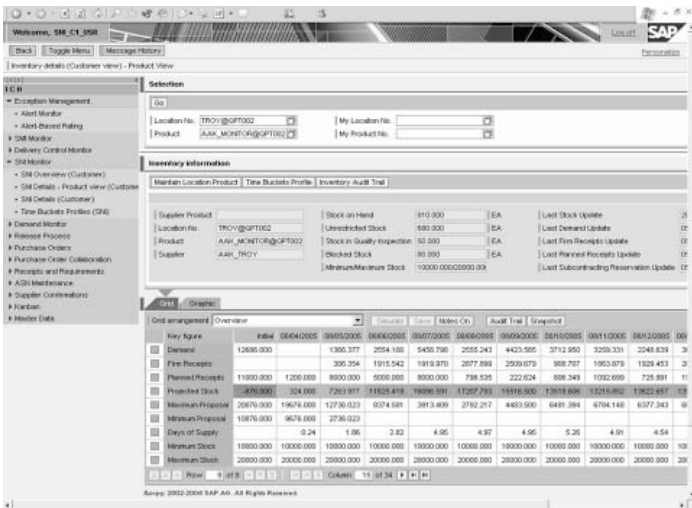


Figure 5: SAP® Role-Based Portals Showing Information As an Actionable, Easy-to-Understand Format

Extending Visibility and Collaboration

When manufacturing is performed in-house, plant-to-business (P2B) information flows must mesh with critical enterprise activities such as costing, planning, and customer deliveries. When these processes are outsourced, however, the complexity of achieving visibility and collaboration increases exponentially. In these environments, shop-floor processes must communicate not only with individual enterprise resource planning (ERP) systems, but also with supply chain collaboration processes that manage the outsourcing contracts. Because common processes such as planning, order management, inventory management, and engineering changes rely heavily on P2B collaboration, they must be extended to incorporate shop-floor events.

To implement this level of cooperation, stakeholders must establish new processes that provide each of the involved partners with the ability to collaborate, and in some cases, negotiate on key order, product, and inventory information. Many companies have put processes in place to support collaboration on typical purchase-order-level information such as dates, quantities, and products. However, outsourced manufacturing requires more sophisticated capabilities.

SAP for High Tech offers core purchasing collaboration functionality that enables brand owners to do the following:

- Provide certain documents, specifications, or packing and shipping instructions to customers
- Comply with processes that are provided or required by a brand owner
- Request and approve changes by either partner on key information such as dates, quantities, components, ship-to addresses, and order-specific product configuration

By providing tools for planning, order management, inventory management, and engineering changes, the SAP solutions help brand owners and other supply chain participants integrate shop-floor-level data and enhance visibility and collaboration.

Enhancing Manufacturing Visibility

When brand owners outsource physical manufacturing for a product or assembly, they typically also outsource related data management activities and business processes. However, brand owners still require visibility and ad hoc communication directly with the contract manufacturer's shop floor. Without it, brand owners cannot improve yields, effectively support ramp-up for new products, improve forecasting, manage variances in supply or demand, or efficiently implement engineering change orders.

SAP manufacturing visibility solutions are designed to do the following:

- Integrate shop-floor data into the enterprise
- Deliver composite analytics for real-time insight

Integrating Shop-Floor Data into the Enterprise

Shop-floor data is collected in extremely high volumes, frequently in near real time. A typical manufacturing plant has between 10 and 50 shop-floor automation systems; a multisite manufacturer may have as many as 40 to 700 shop-floor automation systems across its enterprise. Data from these systems is typically delivered to brand owners through various mechanisms, such as FTP and Web pages.

Connectivity occurs through various file-generation approaches, which deliver information to brand owners through custom portals, FTP, and e-mail. These methods limit the usefulness and timeliness of the information, compromising real-time visibility for the brand owner.

Connectivity must be addressed from several dimensions. SAP supports highly adaptable enterprise integration through an enterprise service-oriented architecture (enterprise SOA) strategy. This strategy allows “plug-and-play” connections between enterprise processes and shop-floor processes. Enterprise SOA enables extremely flexible interaction with core financial, logistical, B2B, and other enterprise processes.

In addition, SAP is working proactively to drive the adoption of the enterprise SOA strategy within the shop-floor systems community. Working with leading shop-floor software vendors, SAP plans to develop defined, packaged integration scenarios between plant and business processes. These partnerships support the joint design of manufacturing services and communication standards that drive connectivity, such as ISA-95, ISA-88, and Open Applications Group (OAG).

Composite Analytics for Real-Time Insight

It's not enough for business users to merely discover information; they also must be able to understand and act on it. Traditional approaches depend on a lengthy process of accumulating information and reporting on it. Often, information arrives days, weeks, or even months after crucial events have occurred. This lag time delays corrective action and often makes it impossible for managers to seize timely opportunities. As a result, yields do not meet expectations, time to volume slows, orders are delayed, and customer satisfaction plummets.

SAP offers a composite analytics approach that provides an alternative to traditional store-and-search data warehousing. This approach assumes that data is not in a single system or data warehouse. Instead, it provides complex key performance indicator (KPI) calculations that can be processed in near real time, across multiple systems, or throughout several supply chain components. This approach empowers managers to make timely decisions. For example, the software can alert decision makers when actual cycle time degrades compared with the time planned. The brand owner or contract manufacturer can then notify the enterprise that manufacturing schedules are at risk and correct the situation on the shop floor.

The SAP solutions help manufacturers provide highly granular information in the correct context. Using an SAP software dashboard, users can intuitively navigate throughout the information. For example, a user may begin by accessing a high-level KPI or alert; if the initial data raises additional questions, the user may drill down to find more detailed data.



Figure 6: Effective Collaboration with SAP® Software Dashboards

SUCCESSING WITH DISTRIBUTED MANUFACTURING

High-tech manufacturers face three inexorable trends: higher cost of manufacturing, shorter product life cycles, and rapidly changing customer demand. While brand owners pursue outsourcing as a key strategy to capitalize on these trends, they also must turn inward to improve the business processes by which outsourcing relationships are managed.

SAP distributed manufacturing solutions are designed to allow companies greater control of their outsourcing relationships and provide critical manufacturing visibility across the supply network. Improvement is delivered by automating critical collaboration processes that enable outsourcing, harnessing manufacturing data to make important information discoverable, and giving managers the tools they need to succeed, regardless of their roles.

The SAP supply chain collaboration and manufacturing visibility solutions do the following:

- Provide visibility into outsourced manufacturing activities
- Alert planners of supply chain disruptions
- Improve integration both internally and externally (with manufacturing partners)
 - Provide timely detection and response to issues on shop floors across the entire manufacturing supply chain
 - Automate the seamless interaction between enterprise and shop-floor-level scheduling, execution, and quality management processes

The SAP for High Tech solution portfolio is designed specifically to meet the needs of high-tech manufacturers engaged in distributed manufacturing processes. These solutions deliver a collaboration platform that provides real-time visibility on supply chain data without batch integrating the data into a single system.

They provide sales and marketing visibility into supply constraints for help with planning and executing new campaigns. They provide KPI management beyond their own “walls” for immediate and accurate available-to-promise capabilities without complex custom integration efforts to link legacy and best-of-breed systems.

Only SAP distributed manufacturing solutions provide brand owners with a secure platform containing a single repository of outsourced manufacturing information. Supply availability is thereby ensured, and users can manage inventory liability and better direct outside resources to meet customer demand.

To learn more about how SAP software can help you enhance manufacturing collaboration and visibility, call your SAP representative today or visit us on the Web at www.sap.com/industries/hightech.

ABOUT THE AUTHORS

This paper was co-authored by specialists within the SAP high-tech industry business unit (IBU) and Technology Forecasters Inc. (TFI). The high-tech IBU consists of industry specialists looking after solution management, business development, and marketing strategy, and provides the worldwide regional industry support for the SAP field organizations and their integration partners. The high-tech IBU is a part of the discrete industries organization within SAP.

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